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Sawada et al.

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(54) **CHARGING CONNECTOR**

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H01R 2201/26 (2013.01); **Y02T 10/7005**
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(58) **Field of Classification Search**

USPC 439/310, 587, 304, 34, 695, 626
See application file for complete search history.

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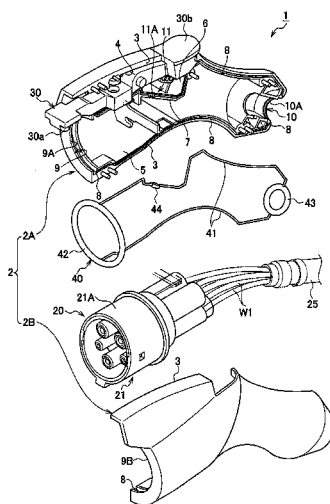
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ABSTRACT

A seal member (40) is formed of an integral body including a case split surface seal portion (41) arranged along whole circumferences of abutting surfaces (3, 7) surrounding a portion of a connector body (20) housed inside an exterior case (2) and interposed between the abutting surfaces (3, 7) of two case split bodies (2A, 2B), a connector body seal portion (42) arranged along a whole circumference of a connector fitting portion projecting hole (9) and interposed between the exterior case (2) and the connector body (20), and an electric wire seal portion (43) arranged along a whole circumference of an electric wire pullout hole (10) and interposed between the exterior case (2) and an electric wire (W1) pulled out from the connector body (20) and led outside the exterior case (2) through the electric wire pullout hole (10).

1 Claim, 5 Drawing Sheets



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FIG. 1
Prior Art

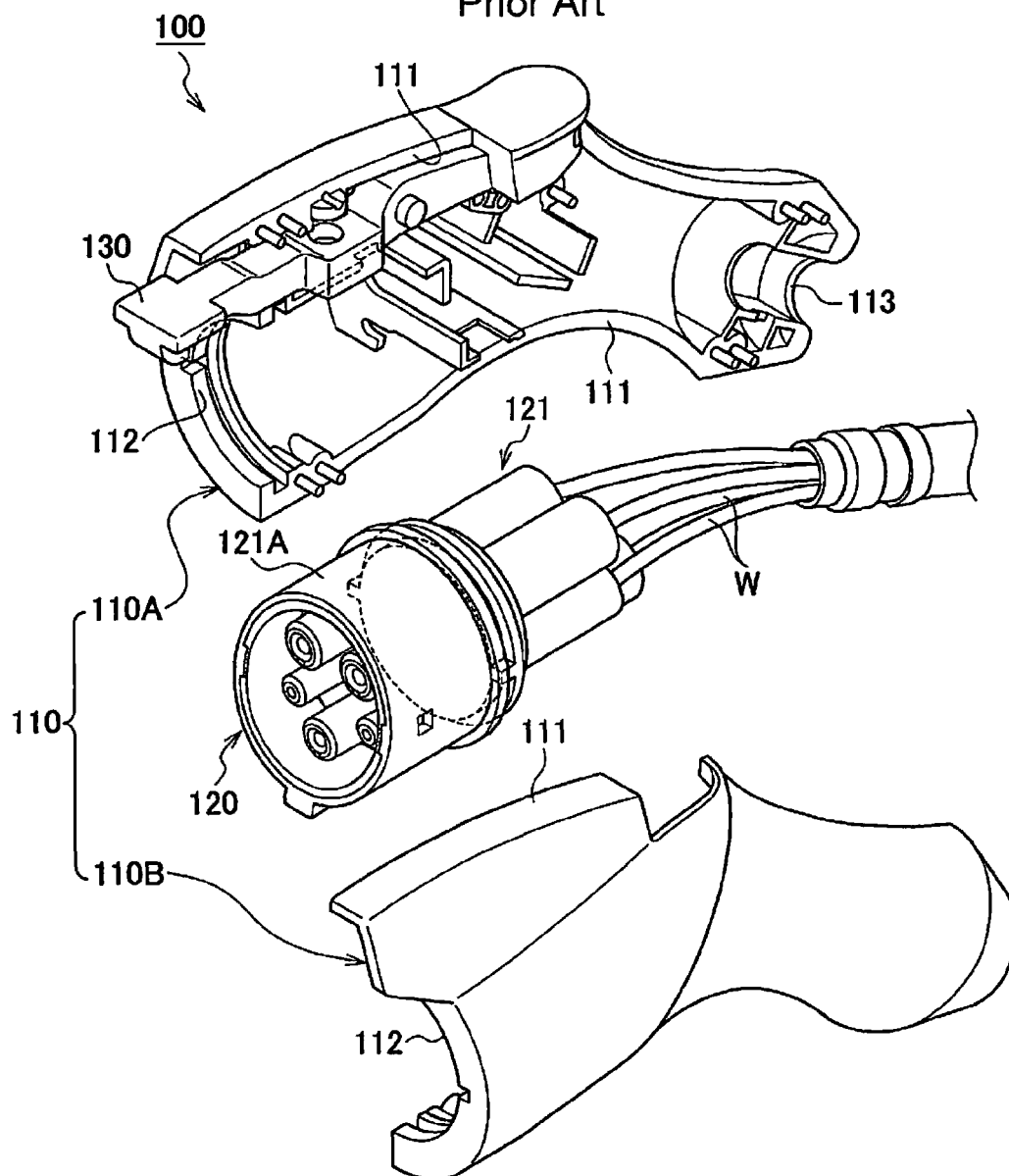


FIG. 2

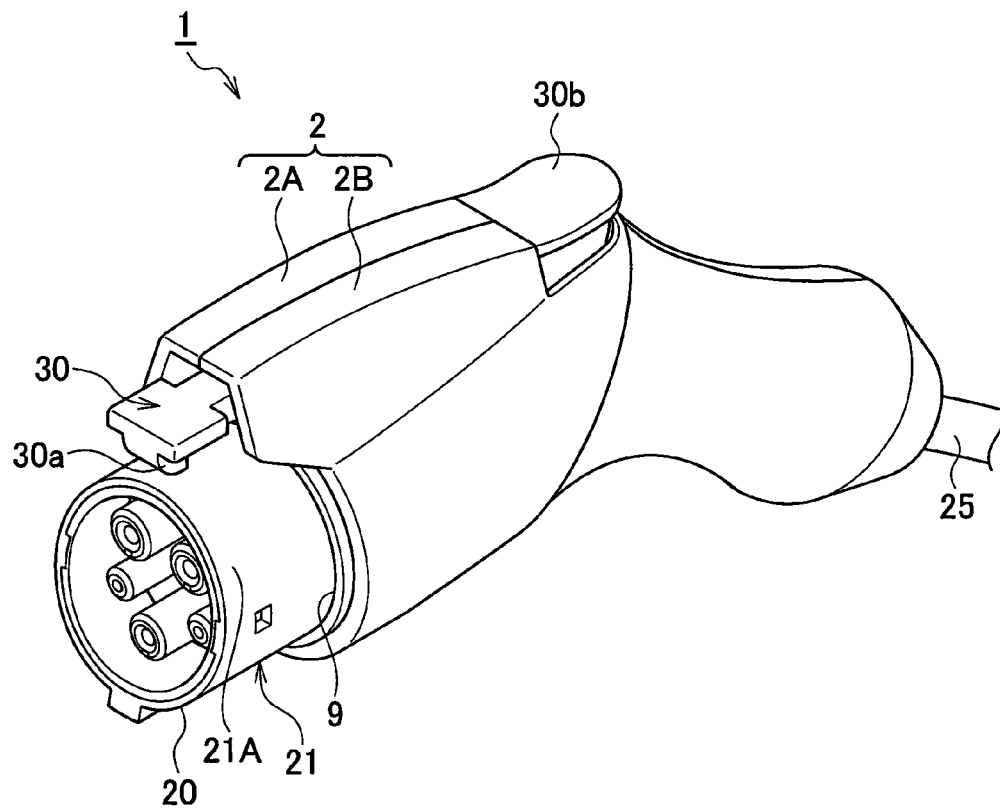


FIG. 3

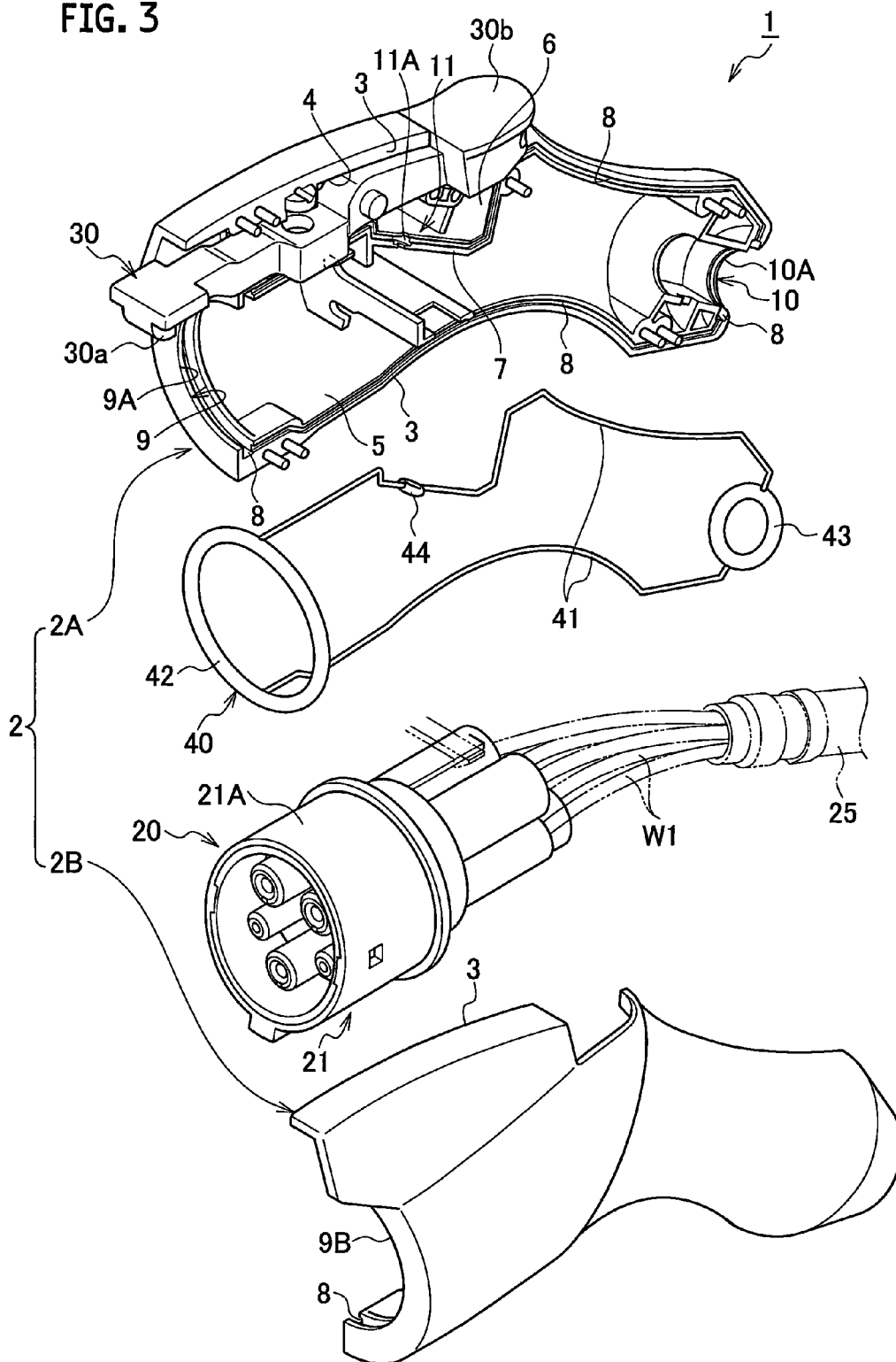


FIG. 4

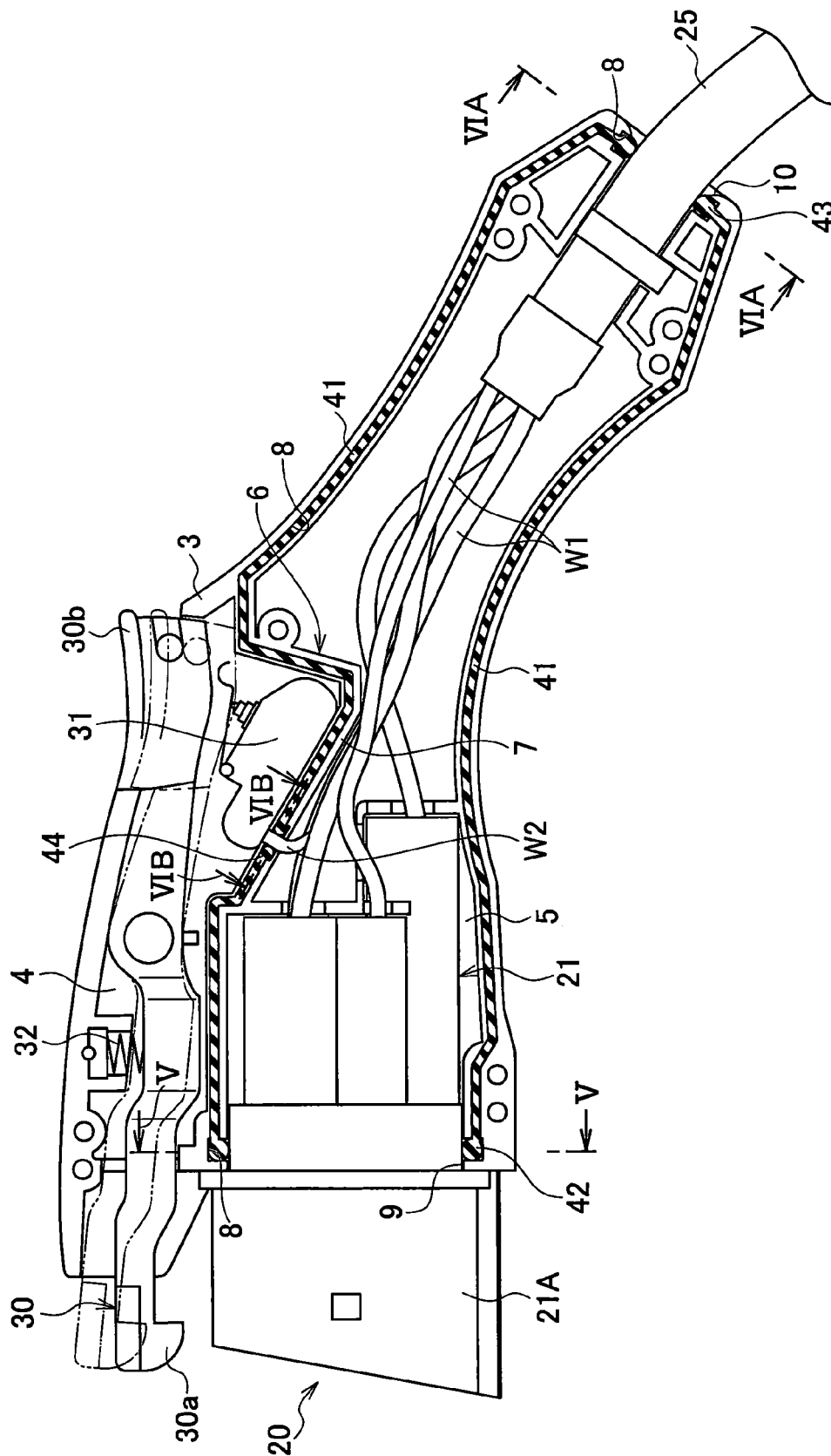


FIG. 5

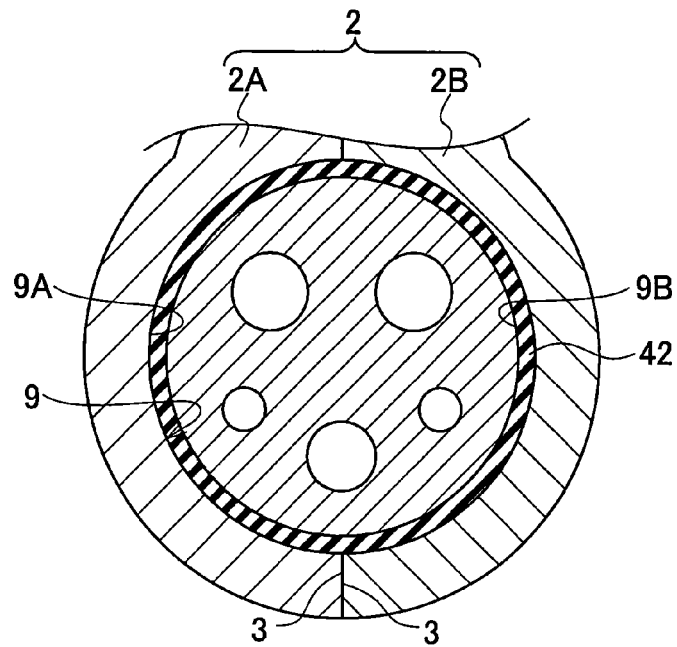


FIG. 6A

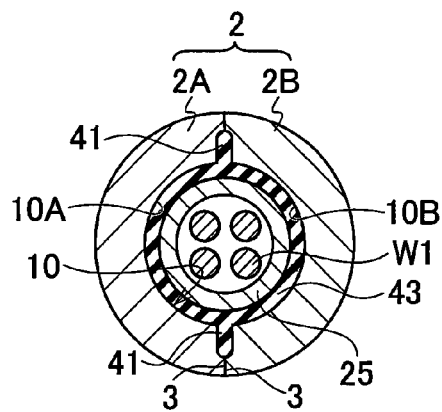
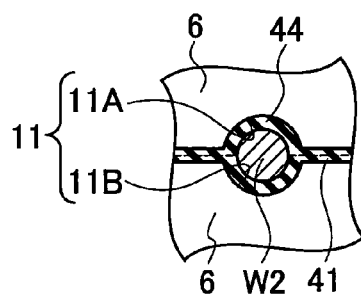


FIG. 6B



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CHARGING CONNECTOR

TECHNICAL FIELD

The present invention relates to a charging connector used at the time of charging a battery mounted on a vehicle such as an electric vehicle or a hybrid electric vehicle.

BACKGROUND ART

A charging connector has been used for charging a battery mounted on a vehicle such as an electric vehicle (EV) or a hybrid electric vehicle (HEV) (see Patent Literature 1). An example relating to this type of charging connector is described by reference to FIG. 1.

As shown in FIG. 1, a charging connector **100** includes an exterior case **110**, a connector body **120** arranged in the inside of the exterior case **110**, and a lock arm **130** arranged in the inside of the exterior case **110**.

The exterior case **110** is formed of two case split bodies **110A**, **110B**. The respective case split bodies **110A**, **110B** have abutting surfaces **111** which are made to come into contact with each other, and the exterior case **110** is formed by making the abutting surfaces **111** come into contact with each other. A connector fitting portion exposing hole **112** is formed in a front end portion of the exterior case **110**. An electric wire pullout hole **113** is formed in a rear end side of the exterior case **110**.

The connector body **120** includes: a connector housing **121**; and a plurality of terminals (not shown) housed in a terminal housing chamber (not shown) of the connector housing **121**. A front portion of the connector body **121** projects to the outside of the exterior case **110** through the connector fitting portion projecting hole **112**. This projecting portion forms a connector fitting portion **121A** which is fitted into an electricity receiving inlet device (not shown).

Electric wires **W** are respectively connected to respective terminals (not shown). Rubber plugs (not shown) are mounted on an electric wire wiring portion of the connector housing **121**. Due to such a connection, the intrusion of water into the inside of the connector housing **121** is prevented. The respective electric wires **W** pulled out from the connector housing **121** are led out to the outside of the exterior case **110** through the electric wire pullout hole **113**.

The lock arm **130** is swingably supported on the exterior case **110**. A front side and a rear side of the lock arm **130** are respectively exposed from the exterior case **110**. The lock arm **130** is located at an unlocked position in a step of fitting into the charging inlet device (not shown), and is positioned at a locked position at a fitting completion position.

In the above-mentioned related art, even when water intrudes into the inside of the exterior case **110**, the rubber plugs prevent intruded water from reaching a terminal (not shown) position of the connector housing **121**. Accordingly, waterproofing of terminals (not shown) is ensured.

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2010-182471

SUMMARY OF INVENTION

The rubber plugs are expensive, and it is necessary to provide the rubber plugs the number of which corresponds to

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the number of terminals. Accordingly, a cost of parts, an assembling operation cost and the like are pushed up, thus pushing up a cost of the charging connector **100**. The greater the number of terminals, the more the cost is pushed up.

It is an object of the present invention to provide a charging connector having the structure which waterproofs terminals at a low cost.

A charging connector in accordance with some embodiments includes: an exterior case having two case split bodies assembled to each other with abutting surfaces of the two case split bodies being in contact with each other, the two case split bodies as assembled having a connector fitting portion projecting hole and an electric wire pullout hole; a connector body housed inside the exterior case and having a connector fitting portion exposed outside the exterior case through the connector fitting portion projecting hole; and a seal member formed of an integral body including a case split surface seal portion arranged along whole circumferences of the abutting surfaces surrounding a portion of the connector body housed inside the exterior case and interposed between the abutting surfaces of the two case split bodies, a connector body seal portion arranged along a whole circumference of the connector fitting portion projecting hole and interposed between the exterior case and the connector body, and an electric wire seal portion arranged along a whole circumference of the electric wire pullout hole and interposed between the exterior case and an electric wire pulled out from the connector body and led outside the exterior case through the electric wire pullout hole.

According to the above-mentioned constitution, the intrusion of water into the connector body in the inside of the exterior case is prevented by the seal member and hence, waterproofing of the terminals in the inside of the connector body can be realized. The seal member is a single part which is interposed between two case split bodies, and is also assembled between the exterior case and the connector body as well as between the exterior case and the electric wire. Accordingly, compared to the case where waterproof plugs are mounted on terminals respectively, a cost of parts, an assembling cost and the like can be reduced. Further, even when the number of terminals is increased, the constitution does not push up a cost. Accordingly, the present invention can provide a charging connector having the structure which waterproofs terminals and can be manufactured at a low cost.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is an exploded perspective view of a charging connector according to the related art.

FIG. 2 is an overall perspective view of the charging connector according to one embodiment of the present invention.

FIG. 3 is an exploded perspective view of the charging connector according to one embodiment of the present invention.

FIG. 4 is a cross-sectional view of the charging connector according to one embodiment of the present invention.

FIG. 5 is a cross-sectional view taken along a line V-V in FIG. 4.

FIG. 6A is a cross-sectional view taken along a line VIA-VIA in FIG. 4.

FIG. 6B is a cross-sectional view taken along a line VIB-VIB in FIG. 4.

DESCRIPTION OF EMBODIMENTS

An embodiment of the present invention will be described hereinafter with reference to the drawings.

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FIG. 2 to FIG. 6B show one embodiment of the present invention. As shown in FIG. 2 to FIG. 4, a charging connector 1 includes: an exterior case 2; a connector body 20 which is housed in the inside of the exterior case 2; a lock arm 30 which is arranged in the inside of the exterior case 2; a micro switch 31 which is turned on or off by the lock arm 30; and a seal member 40.

The exterior case 2 is constituted of two case split bodies 2A, 2B which are assembled to each other. An abutting surface 3 is formed on the substantially whole outer periphery of each case split body 2A, 2B. Each case split body 2A, 2B has a lock arm housing chamber 4 and a connector housing chamber 5 therein, and these housing portions 4, 5 are partitioned from each other by an inner partition wall 6. A distal end surface of the inner partition wall 6 forms an abutting surface 7. A seal holding groove 8 is formed on the abutting surfaces 3, 7 which surround the connector housing chamber 5.

Two case split bodies 2A, 2B are assembled to each other in a state where the abutting surfaces 3, 7 of the case split bodies 2A, 2B are in contact with each other. Front end portions and rear end portions of the respective case split bodies 2A, 2B are formed into semicircular arc-shaped recessed portions 9A, 9B respectively. In an assembled state of the exterior case 2, a connector fitting portion projecting hole 9 is formed by both recessed portions 9A, 9B formed on the front end portions of the case split bodies 2A, 2B. In an assembled state of the exterior case 2, an electric wire pullout hole 10 is formed by both recessed portions 10A, 10B formed on the rear end portions of the case split bodies 2A, 2B respectively (see FIG. 5). A circular arc-shaped recessed portion 11A, 11B (see FIG. 6A) is formed on the inner partition wall 6 of each case split body 2A, 2B. In an assembled state of the exterior case 2, an electric wire penetrating hole 11 is formed by the recessed portions 11A, 11B of the inner partition walls 6 of both case split bodies 2A, 2B (see FIG. 6B). A seal holding groove 8 is also formed on inner surfaces of the respective recessed portions 9A, 9B, 10A, 10B, 11A, 11B.

The connector body 20 is housed in the connector housing chamber 5. The connector body 20 includes: a connector housing 21; and a plurality of terminals (not shown) which are housed in a terminal housing chamber (not shown) of the connector housing 21. A front portion of the connector housing 21 forms a connector fitting portion 21A which is fitted in an electricity receiving inlet device (not shown). The connector fitting portion 21A projects to the outside of the exterior case 2 from the connector fitting portion projecting hole 9.

The plurality of terminals (not shown) are constituted of two kinds of terminals, that is, power supply terminals and a fitting detection terminal. Electric wires W1 are connected to respective terminals (not shown). The plurality of electric wires W1 pulled out from the connector housing 21 are housed in a protective tube 25 and are led out to the outside of the exterior case 2 from the electric wire pullout hole 10.

The lock arm 30 and the micro switch 31 are housed in the lock arm housing chamber 4. The lock arm 30 is swingably supported on the exterior case 2. A front side and a rear side of the lock arm 30 are respectively exposed from the exterior case 2. A locking pawl 30a is formed on the front side of the lock arm 30. The rear side of the lock arm 30 forms a release operation portion 30b. The lock arm 30 is biased to a locking side by a spring force of a spring 32.

The inside of a case of the micro switch 31 is filled with an adhesive agent. Due to such a filled adhesive agent, the inside of the micro switch 31 is waterproofed. The micro switch 31 and one fitting detection terminal (not shown) are connected to each other by an inner electric wire W2. Due to such a

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constitution, the presence or the non-presence of a fitting state between the charging connector and a charging inlet device can be detected.

The seal member 40 is made of a rubber material having excellent elasticity. The seal member 40 is formed of an integral body constituted of: a case split surface seal portion 41 which is arranged along the whole circumferences of the abutting surfaces 3, 7 of the case split bodies 2A, 2B which surround the connector body 20 housed in the exterior case 2; a connector body seal portion 42 which is arranged along the whole circumference of the connector fitting portion projecting hole 9; an electric wire seal portion 43 which is arranged along the whole circumference of the electric wire pullout hole 10; and an inner electric wire seal portion 44 which is arranged along the whole circumference of the electric wire penetrating hole 11. The case split surface seal portion 41 is interposed between two case split bodies 2A, 2B, and hermetically seals a gap formed between two case split bodies 2A, 2B by making use of an elastic compression of the case split surface seal portion 41. As will be described in detail by reference to FIG. 5, the connector body seal portion 42 is interposed between the exterior case 2 and the connector body 20, and hermetically seals a gap formed between the exterior case 2 and the connector body 20 by making use of an elastic compression of the connector body seal portion 42. As will be described in detail by reference to FIG. 6A, the electric wire seal portion 43 is interposed between the exterior case 2 and the protective tube 25 for the electric wires W1, and hermetically seals a gap formed between the exterior case 2 and the protective tube 25 for the electric wires W1 by making use of an elastic compression of the electric wire seal portion 43. As will be described in detail by reference to FIG. 6B, the inner electric wire seal portion 44 is interposed between the inner partition walls 6 of both case split bodies 2A, 2B and the inner electric wire W2, and hermetically seals a gap formed between the inner partition walls 6 and the inner electric wire W2 by making use of an elastic compression of the inner electric wire seal portion 44.

In the charging connector 1 having the above-mentioned constitution, the intrusion of water through a gap formed between the case split bodies 2A, 2B is prevented by the case split surface seal portion 41. The intrusion of water into the connector housing chamber 5 from the connector fitting portion projecting hole 9 of the exterior case 2 is prevented by the connector body seal portion 42. The intrusion of water into the connector housing chamber 5 from the electric wire pullout hole 10 of the exterior case 2 is prevented by the wire seal portion 43. The intrusion of water into the connector housing chamber 5 from the electric wire penetrating hole 11 in the exterior case 2 is prevented by the inner electric wire seal portion 44. In this manner, the intrusion of water into the connector housing chamber 5 formed in the exterior case 2, that is, the intrusion of water into the connector body 20 can be prevented by the seal member 40 and hence, the terminals (not shown) in the connector body 20 can be waterproofed. In this embodiment, the seal member 40 is formed of a single part which is interposed between two case split bodies 2A, 2B and is also assembled between the exterior case 2 and the connector body 20 as well as between the exterior case 2 and the electric wires W1. Accordingly, a cost of parts, an assembling cost and the like can be reduced compared to the case where a waterproof plug is mounted on respective terminals (not shown). Further, even when the number of terminals (not shown) is increased, such constitution does not push up a cost. As can be understood from above, this embodiment provides the charging connector 1 having the structure where the terminals (not shown) are waterproofed at a low cost.

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In this embodiment, the seal member **40** includes the inner electric wire seal portion **44** also as an integral part thereof. However, the inner electric wire **W2** may be sealed by a separate seal member.

In this embodiment, the plurality of electric wires **W1** 5 pulled out from the connector body **20** are housed in the inside of the protective tube **25**, and a gap formed between the protective tube **25** and the exterior case **2** is hermetically sealed by the electric wire seal portion **43** and hence, the gap can be easily hermetically sealed. The plurality of electric wires **W1** may not be housed in the protective tube **25**. In this case, a gap formed between the electric wires **W1** and the exterior case **2** is hermetically sealed by the electric wire seal portion **43**. 10

In this embodiment, waterproofing is provided only to the connector housing chamber **5** formed in the inside of the exterior case **2**. However, the seal member **40** may be configured to hermetically seal a gap formed between the exterior case **2** and the swinging lock arm **30** thus providing waterproofing to both the connector housing chamber **5** and the lock arm housing chamber **4**. 15

In this way, the present invention includes various embodiments not described above. Therefore, the scope of the present invention is determined only by the invention identification matters according to claims reasonable from the foregoing description. 20

The entire content of Japanese Patent Application No. 2012-235540 (filing date: Oct. 25, 2012) is incorporated herein by reference. 25

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The invention claimed is:

1. A charging connector comprising:

an exterior case having two case split bodies assembled to each other with abutting surfaces of the two case split bodies being in contact with each other, the two case split bodies as assembled having a connector fitting portion projecting hole and an electric wire pullout hole;

a connector body housed inside the exterior case and having a connector fitting portion exposed outside the exterior case through the connector fitting portion projecting hole; and

a seal member formed of an integral body including a case split surface seal portion arranged along whole circumferences of the abutting surfaces surrounding a portion of the connector body housed inside the exterior case and interposed between the abutting surfaces of the two case split bodies, a connector body seal portion arranged along a whole circumference of the connector fitting portion projecting hole and interposed between the exterior case and the connector body, and an electric wire seal portion arranged along a whole circumference of the electric wire pullout hole and interposed between the exterior case and an electric wire pulled out from the connector body and led outside the exterior case through the electric wire pullout hole.

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